

Hemorrhage And Shock

- This subject is very important for us as Dentists and almost for all physicians

Hemorrhage :

- Simply , hemorrhage means blood loss , and it can be classified according to many things
 - Mainly bleeding is classified according to the site of bleeding to :
 - **Arterial hemorrhage** : the blood is bright red colored and there will be excessive bleeding with systole and the blood will decrease during diastole (follows the heart beats) , and it can be stopped easily
 - **Venous hemorrhage** : blood is dark with diffuse copious bleeding (very much blood) and because of that its difficult to distinguish the source of bleeding and because of that its harder to stop the venous bleeding .
 - **Capillary hemorrhage** :
 - & Most of the times it occur with patients with blood coagulation problems i.e. hemophilia , idiopathic thrombocytopenic purpura ... etc.
 - & Its very difficult to stop the bleeding ,, but there is some fibrin sealants that can be used to stop the bleeding .
 - Also hemorrhage can be classified according to the onset of bleeding :
 - **Primary hemorrhage** : (intra-operative bleeding) : any bleeding that occur in any operation and its easily controlled
 - **Reactionary hemorrhage** : (post-operative bleeding) : may follow primary hemorrhage within the next 24 hrs. usually from four to six hrs.
 - & mostly caused by slipping of the ligature in the site of the wound.
 - & there are many predisposing factors that can cause reactionary hemorrhage like the excessive movement that causes dislodgment of the ligature , another example is the excessive coughing after a thyroid surgery ,, because coughing will lead to increased intra-thoracic pressure .
 - & sometimes after performing a surgery on a hypotensive pt. , the sudden rise in the blood pressure will cause slipping of the ligature
 - & also if we have a wound penetrating a main vein or artery , we do not remove the first aid dressing directly in the ER , because the wound might open and will cause reactionary bleeding and will be hard to stop , rather than that we remove it in the operation theatre.
 - **Secondary hemorrhage** :
 - Usually occur 7-14 days post-operatively , not immediate like reactionary bleeding
 - & commonly caused by sloughing (shedding) of the artery due to ischemia after it has been ligated .

& sometimes tumors can be a cause of secondary bleeding , especially in **renal cell carcinoma** , because after the resection of the tumor , there might be a tumor impulse in the blood that will progress and may rupture the vessels and cause a secondary hemorrhage .

- The final classification of hemorrhage is according to the site of bleeding :
 - **Internal bleeding** : invisible
 - **External bleeding** : can be seen& there is some cases where an internal bleeding will be converted to an external bleeding , like in peptic ulcer pts. , there might be upper GI tract bleeding that leads to hematemesis (vomiting of blood) or melena (blood in stool)
& other example in some kidney injuries or carcinoma , pts. Will have hematuria (blood in urine)

Measurement Of Blood Loss :

- The most important thing to do after the occurrence of hemorrhage is to assess the volume of the lost blood .
- When measuring the volume of blood loss , we always depend on the percentage of blood loss rather than the volume it self , because the total volume of blood differs from adults and infants or children.

Adults = 65-75 ml/kg

infants = 80-85 ml/kg

- The question now is how can we assess the blood loss ?
Intra operatively , we use many things for the assessment of blood loss , like the **abdominal pads** :

- When the collected blood clot is measured against the pt's clinched fist , its almost equal to 500 ml and nearly it equals 10 % of the total blood volume , also we can assess the blood loss by measuring the total blood collected in the **suction**
- The best way of measuring blood loss is by using the **swab weighing** : we subtract the dry weight of the blood collected from the pt. from the wet weight , and every g = ml blood



ex. If we have an abdominal pad that weighted 500 g and post-operatively was 100 g
 $500 - 100 = 400$ ml of blood lost

- **Hemoglobin** levels also can be used to measure blood loss , but the main disadvantage of using it is that it's level takes along time to change in acute blood loss , so if we had a case with internal bleeding and we immediately sent a blood sample to check for the hemoglobin level , we will find it normal (12-16 g/dl) , so we should not depend on this method to assess blood loss .

Hypovolemia

- Hypovolemia is the main consequence of hemorrhage , and it's a medical emergency that may lead to decreased perfusion of blood to the organs and ends with multi-organs failure .
- Hypovolemia can be classified into three major categories :

1- Compensated Hypovolemia :

- It's the **commonest** type of Hypovolemia , but it's the least diagnosed because our body will compensate spontaneously for the volume that has been lost .
- Almost all cases share one symptom which is **dehydration** and the person becomes thirsty
- **Normal** respiratory rate .

2- Overt Compensated Hypovolemia :

- Patient with stable blood pressure , but most of the times there is **reflex tachycardia** that occurred by the drive of the sympathetic nervous system
- Maybe associated with some **CNS symptoms** : drowsiness , restlessness , agitation (3a9abyah) And all of that is due to decreased perfusion of the blood to the brain
- There is **increased** respiratory rate .

3- Decompensated Hypovolemia :

- It's the most **serious** condition of Hypovolemia
- Clinically , pt. manifested by sever **hypotension** , impalpable pulse (unfelt pulse) , and decreased level of consciousness .
- There is **ventilation-perfusion mismatch** in the lungs : lungs receive air but there is decreased perfusion to the lungs which results in sever hypoxemia (↓O₂) in the blood
- **Tachypnea** (↑respiratory rate) also pronounced in decompensated Hypovolemia
- If there is no or late medical intervention , it will end up with cardiac arrest and death

Shock :

- The most accurate definition of shock that its described by decreased perfusion of blood at the cellular level , regardless of the cardiac conditions , maybe you can see a patient with normal pulse but he is shocked !
- Shock can be classified to two categories according to the site of the problem
 - Decrease in the circulating volume of the blood (pre-load) : problem in the blood
 - Compromised cardiac function : problem in the heart

1- Decreased circulating volume of the blood (**pre-load**) :

There are many things that causes blood loss ,

- True Hypovolemia : many causes like direct blood loss or plasma loss , or vomiting or dehydration
- Apparent Hypovolemia : caused by vasodilatation of the vessels that results in decreased pre-load , and the causes might be :
 - Adrenal insufficiency
 - Anaphylaxis : i.e. : a pt. that is allergic to penicillin and received a high dose of it that caused peripheral vasodilatation .
 - Neurogenic factors : like in spinal cord injury that causes peripheral vasodilatation
 - Sepsis : an infection by bacteria that causes peripheral vasodilatation and leads to decreased perfusion of blood to the vital organs .

2- Compromised cardiac function :

- ✓ **Extrinsic** : i.e. a fluid aggregation in the pericardium that causes cardiac compression shock
- ✓ **Intrinsic** : specially in myocardial infarction pts.

**** true Hypovolemia is the commonest cause of shock .**

Pathophysiology Of Shock :

- At the cellular level , normally we use aerobic metabolism pathway to produce ATP's
Now if there is decreased perfusion , this will lead to decreased O₂ levels in the cells and they will have to use the anaerobic pathway to produce ATP , but it will also results in the deposition of **lactic acid** , and as the amount of acid increase it will lead to systemic acidosis and will inhibit most of the body's enzymes that work naturally in a neutral field .
- Also there are some changes at the cellular level , like the **increase of intra-cellular sodium and calcium** and this will affect the contractility of the whole muscles
- Also the immune system will be affected due to the decreased level of O₂ because some defense cells like macrophages need oxygen to be activated

- Shock also may lead to **adult respiratory distress syndrome (ARDS)** because also the neutrophils will be inhibited
- Also shock may lead to **disseminated intravascular coagulation (DIC)** : which is destruction of all clotting factors and the platelets and the pt. will bleed easily .
- Hemorrhagic shock is classified according to the volume of blood loss :
 - **Mild loss (<20% loss)** : most of the times , patients present with pallor (sho7ob) and cold extremities that was caused by peripheral vasoconstriction in order for the blood to supply central vital organs , also pts. manifested by tachycardia and collapsed veins .
 - **Moderate loss (20-40% loss)** : pts. Present with all previous symptoms in addition to **oliguria** (decreased urine output) and **postural hypotension** .

Postural hypotension : normal blood pressure in supine position but decreased BP when standing up

- **Sever loss (>40% loss)** : pt. presents with all previous symptoms in addition to **CNS manifestation**: i.e. drowsiness , restlessness , agitation ...etc.
- Any hemorrhage <20% of lost blood and stopped , most of the times will not require medical intervention .

Management Of Treatment Of Shock

Ex. : A thirty year old male was involved in road traffic accident , and injured his femoral artery , after blood assessment , we found that he lost 30 % of his blood .

- The first initial step is to **stop the external bleeding** , then to insert two large cannula of fluid intra-venously , then Oxygen administration ,

Fluids : usually we use two types of fluids :

- **Crystalloids** : fluids containing only electrolytes (K,Cl,Na..etc.) , the main disadvantage of crystalloids that for every 1 ml of lost blood will require 2-3 ml of crystalloids to compensate for it .
- **Colloids** : fluids containing proteins or dextrans (polysaccharides) , colloids will expand the intra vascular volume faster than crystalloids , the main disadvantages of colloids is that they have side effects and they are expensive
- Most surgeons prefer using crystalloids rather than colloids
- Some surgeons use glucose water , but it may lead to water intoxication

- Supplement of high amount of O₂ is recommended , although there are some fears of oxygen intoxication but it is not proved
- After that we insert the adequate amount of blood needed in addition to plasma and clotting factors if needed

Pharmacological treatment of shock patients :

Mostly they are **inotropic agents** , used to restore an adequate cardiac output , and to prevent vasoconstriction , especially in the kidneys :

- **Dopamine** : improves the cardiac output and also urine output
- **Dobutamine** : it's a selective β_1 -adrenergic receptor , and usually it has more inotropic effect on the heart than dopamine

Finally , always remember to treat the cause of the shock first (anaphylaxis , sepsis ...etc.) first , then proceed with the treatment

- The last paper of the slides which is additional treatment , the dr. did not mention anything about it so I just copied it :

Additional treatment :

- In general pts , should be adequately resuscitated from shock before surgery .
- A pt. with good diuresis is less likely to suffer post-operative renal failure .
- In some cases full resuscitation prior to surgery is not possible (ex. : ruptured ectopic pregnancy , leaking aortic aneurysm)
- In such cases its usually better to start the resuscitation & operate upon the patient without waiting for the hemostability first
- In general , treat shock very early , treat the cause , start resuscitation , control the blood pressure of the pt. , the pulse & urine output , be aggressive & never lose time because if the shock is allowed longer , the stage of the irreversibility maybe reached & no treatment will benefit the patient.

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